

TITLE:

GCM studies on the interactions between photosynthesis and climate at diurnal to decadal time scales.

AUTHORS:

G. James Collatz, Lahouari Bounoua, Piers Sellers, Sietse Los, David Randall, Joseph Berry, Compton J. Tucker

ABSTRACT

Transpiration, a major component of total evaporation from vegetated surfaces, is an unavoidable consequence of photosynthetic carbon fixation. Because of limiting soil moisture and competition for solar radiation plants invest most of their fixed carbon into structural and hydraulic functions (roots and stems) and solar radiation absorption (leaves). These investments permit individuals to overshadow competitors and provide for transport of water from the soil to the leaves where photosynthesis and transpiration occur. Often low soil moisture or high evaporative demand limit the supply of water to leaves reducing photosynthesis and thus transpiration.

The absorption of solar radiation for photosynthesis and dissipation of this energy via radiation, heat, mass and momentum fluxes represents the link between photosynthesis and climate. Recognition of these relationships has led to the development of hydro/energy balance models that are based on the physiological ecology of photosynthesis.

We discuss an approach to study vegetation-climate interactions using photosynthesis-centric models embedded in a GCM. The rate at which a vegetated area transpires and photosynthesizes is determined by the physiological state of the vegetation, its amount and its type. The latter two are specified from global satellite data collected since 1982. Climate simulations have been carried out to study how this simulated climate system responds to changes in radiative forcing, physiological capacity, atmospheric CO<sub>2</sub>, vegetation type and variable vegetation cover observed from satellites during the 1980's.

Results from these studies reveal significant feedbacks between the vegetation activity and climate. For example, vegetation cover and physiological activity increases cause the total latent heat flux and precipitation to increase while mean and maximum air temperatures decrease. The reverse occurs if cover or activity decreases. In general climate response of a particular region was dominated by local processes but we also find evidence that plausible climate-vegetation scenarios lead to changes in global atmospheric circulation and strong non-local influences in some cases.

AMSA

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## American Geophysical Union

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October 27, 1998

G James Collatz  
Biospheric Sciences Branch  
Code 923  
NASA's Goddard Space Flight Center  
Greenbelt, MD 20771  
United States

Dear G James Collatz:

The Fall Program Committee has accepted the abstract listed below for presentation at the AGU 1998 Fall Meeting being held December 6-10, 1998, at the Moscone Center in San Francisco, California. Please notify any coauthors of this acceptance as this is the only correspondence you will receive.

Title: GCM Studies of the Interactions Between Photosynthesis and  
Climate at Diurnal to Decadal Time Scales.

Location: Moscone Center

Room Name/No.: 302

Paper Number: **H42E-03**

Presentation Type: Oral

Starting Time: 1410h

Time Allotted: 20 \*

The paper number is interpreted as follows:

<u>Section</u>	<u>Day</u>	<u>Time</u>	<u>Concurrent Session</u>	<u>Sequence in Session</u>
H = Hydrology	4 = Thurs	2 = PM	E	03

\* Please allow five minutes for discussion and changeover time between speakers for a standard 15 minute oral presentation. See enclosed for more information.

A submission fee of \$70 was received for this abstract. This letter is your receipt if you paid by check or credit card. The abstract submission fee is a handling fee and is in addition to the meeting registration fee. All meeting participants must pay a registration fee to attend the meeting. The registration form as well as hotel information and the complete technical program can be found on the AGU web site (<http://www.agu.org>). Abstracts for the meeting will be published in the November 10, 1998, supplemental issue of Eos.

We look forward to seeing you in San Francisco.

Sincerely,

Johanna Merryman  
Meetings Secretary

Enclosures

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**General Information**  
**AGU 1998 Fall Meeting**  
**Moscone Convention Center**  
**San Francisco, California**  
**December 6-10, 1998**  
**(Sunday through Thursday)**

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## **Sponsors**

**American Geophysical Union (AGU)** is a society of over 35,000 members in 115 countries with purpose of advancing progress in the Earth, atmospheric, oceanic, hydrologic, and space and planetary sciences. AGU is dedicated to fostering high-quality scientific research, disseminating the results of that research, enhancing educational opportunities in science, and encouraging international cooperation in geophysics.

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## **Meeting Dates**

The 1998 Fall Meeting will offer 5 days of scientific programming, beginning Sunday, December 6, and continuing through Thursday, December 10. Registration and the opening reception will be held on the evening of Saturday, December 5.

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## **San Francisco, California (Moscone Center)**

Everyone loves San Francisco -- and no wonder! It has something for everyone: grand opera and honky-tonk, dim sum and fettuccine, cappuccino and steam beer, stunning vistas and cozy firesides, and living history and livelier nights. It's America's most romantic, most cosmopolitan, and most hauntingly beautiful city.

Travel by century-old cable cars through fascinating neighborhoods to the landmark Fisherman's Wharf. Visit Alcatraz, once the country's toughest maximum security prison and now a national park. Take a leisurely stroll through Golden Gate Park, with its Japanese tea garden, ocean beach, and barking sea lions or do some serious shopping in Union Square (just four blocks from the Moscone Center -- site of the 1998 AGU Fall Meeting Sessions).

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## Program

This meeting provides an outstanding opportunity for researchers, teachers, students, and consultants to review the latest issues affecting the Earth, the planets, and their environment in space.

You may contribute to the success of this meeting by submitting an abstract and attending the presentations. Don't miss this chance to attend scientific sessions targeting your specific needs and interests, and to meet with your colleagues to review the latest developments in your field.

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## Program Committee

**Meeting Chairman (U)**, Robert A. Duce, Department of Oceanography, Room 906, O&M Building, Texas A&M University, College Station, TX 77843 USA; Tel: +1-409-845-5756, Fax: +1-409-862-8978; E-mail: [rduce@ocean.tamu.edu](mailto:rduce@ocean.tamu.edu)

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**Tectonophysics (T)**, Chair, Christopher R. Kincaid, Graduate School of Oceanography, University of Rhode Island, South Ferry Road, Narragansett, RI 02882-1197 USA; Tel: +1-401-874-6571; Fax: +1-401-874-6811; E-mail: [kincaid@lighthouse.gso.uri.edu](mailto:kincaid@lighthouse.gso.uri.edu); Committee Member: Roland Burgmann, Department of Geology, One Shields Avenue, University of California, Davis, CA 95616 USA; Tel: +1-530-752-6808; Fax: +1-530-752-0951; E-mail: [burgmann@geology.ucdavis.edu](mailto:burgmann@geology.ucdavis.edu)

**Volcanology, Geochemistry and Petrology (VGP)**, Mary R. Reid, Department of Earth and Space Sciences, University of California, Los Angeles, Los Angeles, CA 90095-1567 USA; Tel: +1-310-825-1756; Fax: +1-310-825-2779; E-mail: [reid@ess.ucla.edu](mailto:reid@ess.ucla.edu)

**Mineral and Rock Physics**: Pamela C. Burnley is a subcommittee member for G, T, and VGP, and will be organizing sessions related specifically to rock and mineral physics: Pamela C. Burnley, Georgia State University, Department of Geology, 340 Kell Hall, 24 Peachtree Center Ave., Atlanta, GA 30303 USA; Tel: +1-404-651-2700 or 2272; Fax: +1-404-651-1376; E-mail: [burnley@gsu.edu](mailto:burnley@gsu.edu)

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## Programs for Students

Students are encouraged to participate by

- proposing sessions
- submitting an abstract
- attending the meeting

**Reduced registration fees**

**Affordable housing options available**

**Best Paper Award**

- all first-author students presenting a paper are eligible to win

**Student Travel Grant Program**

- provides a selected number of students presenting papers, grants of \$250 or \$500

## Guest Registration

Guests or spouses not attending the scientific sessions may register at the meeting at no charge. Guests who wish to attend a section event or the Awards Banquet must purchase ticket(s) in advance.

## Receipt

The preregistration receipt will be attached to your badge, which will be given to you at the time of registration.

## Cancellations

- You must send written notification of cancellations to AGU headquarters.
- The full registration fee will be refunded if written notification is received at AGU headquarters by November 20, 1998.
- Between **November 21, 1998** and **November 27, 1998**, a **\$20** processing fee will be deducted from the amount paid.
- Refunds will not be processed after **November 27, 1998**.
- Notification to cancel tickets for events will not be honored unless received by November 27, 1998.

## Registration Rates

	Before November 6, 1998	After November 6, 1998
<b>Regular Member</b>		
(More than 1-Day)	\$ 215	\$ 250
(1-Day)	\$ 108	\$ 143
<b>Student Member</b>		
(More than 1-Day)	\$ 95	\$ 130
(1-Day)	\$ 47	\$ 82
<b>Undergraduate Member</b>		
(More than 1-Day)	\$ 30	\$ 65
(1-Day)	\$ 15	\$ 50
<b>Retired Senior Member*</b>		
(More than 1-Day)	\$ 95	\$ 130
(1-Day)	\$ 47	\$ 82
<b>Nonmember</b>		
(More than 1-Day)	\$ 255	\$ 290
(1-Day)	\$ 128	\$ 163
<b>Student Nonmember</b>		

(More than 1-Day)	\$ 135	\$ 170
(1-Day)	\$ 67	\$ 102

*\* Age 65 or older and retired from full-time employment*

## Cooperating Societies

Members of these cooperating societies may register at the 'member' rates.

- UGM - Union Geofisica Mexicana
- ACSM - American Congress on Surveying and Mapping
- ASP - American Society of Photogrammetry & Remote Sensing
- CGU - Canadian Geophysical Union
- EGS - European Geophysical Society
- GS - Geochemical Society
- AMS - American Meteorology Society

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## Travel Services Information

### Airline Discounts

**Save money on your travel costs to San Francisco!** Discounts and special fares are available through **United Airlines**. If you or your travel agent call United's toll free number to book your reservations, you will receive a 5% discount off the lowest applicable discount fare, including First Class, or a 10% discount off mid-week coach fares, purchased 7 days in advance. Attendees purchasing United airline tickets at least 60 days in advance of the travel dates will be able to receive an additional 5% discount off the already discounted or special fare.

To obtain these special discount fares, you or your travel agent must contact United's Convention Sales Department at the number listed below and be sure to provide United's Meeting ID number:

United Convention Sales  
1-800-521-4041  
7:00 A.M. - 12:00 midnight (est)  
Meeting ID #569RS

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## Insurance Coverage

Participants traveling from outside the U.S. may wish to purchase accident and medical insurance protection during their visit to San Francisco. Seabury and Smith, an association service organization, offers coverage through their Gateway USA program. Insurance must be purchased for a minimum of 15 days, up to a maximum of 60 days. Prices will vary depending upon the individual's age and choice of benefit package. For more information, contact Seabury and Smith at +1-202-457-6842.

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## Accommodations

Hotels have been selected on the basis of location, availability, price, safety, and desirability.